

WSDOT's Linear Referencing Systems Frequently Asked Questions:

1.) What is a Linear Referencing System (LRS)?

A LRS is a method for locating data (point features such as intersections, linear features such as guardrails, and events such as collisions) at a measured distance along a particular linear feature from its beginning.

2.) How are distances measured along a LRS?

Distances along the linear feature are called measures and can be in various units such as feet, miles, kilometers, or percentages. Transportation features are located along state highways from their beginning by Accumulated Route Mileage (ARM) and State Route MilePost (SRMP) values.

3.) What are the different types of LRS's at WSDOT?

There are two basic types, the DMI LRS ([tabular](#)) and Spatial LRS ([graphical](#)), described in more detail below.

What is the DMI LRS?

The oldest, still in use today, is the DMI method which was developed before the advent of GPS and GIS technology. It is a one dimensional system that measures distance along a linear element. The linear element has no relationship to its position on the earth. At WSDOT, the DMI LRS is created by driving state highways with a vehicle mounted Distance Measuring Instrument (DMI), a high accuracy odometer. The DMI is set to zero at the beginning of the route and calibrated against fixed points along the highway, such as bridge seats and intersections. Static features along the route are measured with the DMI. These features are recorded in the TRansportation Information and Planning System (TRIPS) database and reported in the State Highway Log. The DMI is +/- 52.8 ft in linear accuracy.

The calibrated features from the DMI are also used to calibrate the 24k and 500k spatial LRSs described below.

What is a Spatial LRS?

A spatial LRS is a representation of linear elements by X,Y coordinates in relationship to the earth's surface. It is used for spatial reference in a Geographic Information System (GIS). The GIS uses dynamic segmentation technology to locate points and segments along a linear element (for WSDOT, our state highways). WSDOT has three different spatial LRSs that have evolved over time to increase the horizontal accuracy and level of detail: the [500k](#) (+/- 200 ft), the [24k](#) (+/- 40 ft), and the recently completed [GPS/LRS](#) (+/- 5 ft).

The 500K depicts state routes with one line representing the highways geographic location. The 24K depicts undivided State Routes with a single line and divided State Routes with two lines. Both LRS's were developed by digitizing paper maps and ortho photos of the state highway network. The [GPS/LRS](#) depicts all State Routes with two lines. The GPS/LRS was developed by driving the state highway network with a vehicle mounted GPS receiver. As WSDOT collects more data with GPS, the GPS/LRS will provide a much more accurate LRS to associate this new data.

4.) Which LRS should I use?

It depends on the type of work you are doing and the level of detail needed. The table on the following page provides information about each LRS that should help you determine which one is most appropriate for your work.

	DMI LRS	24K LRS	500K LRS	GPS LRS
How can I access it?	<ul style="list-style-type: none"> • TRIPS • Roadway Data Mart • State Highway Log 	GIS Workbench	GIS Workbench	GIS Workbench
Type of Uses	<ul style="list-style-type: none"> • Used in office as a reference guide • Used in field with a DMI 	<ul style="list-style-type: none"> • Used with x,y coordinate data • Used for mapping purposes, i.e., regional, county maps, etc. 	Summary level maps, i.e., statewide maps	Detailed map views, i.e., breakdown of travel ways
Limitations	<ul style="list-style-type: none"> • Decreasing milepost location values are derived from increasing milepost direction of travel • Values are derived from DMI • Not graphical. 	<ul style="list-style-type: none"> • Decreasing milepost location values are derived from increasing milepost direction of travel • Values are derived from DMI 	<ul style="list-style-type: none"> • Displays increasing direction of travel only • Values are derived from DMI 	<ul style="list-style-type: none"> • Provides GPS/LRS ARM values only at this time • No TRIPS SRMP or ARM values.

Accuracy Level	Linear accuracy is +/- 52.8 ft	Horizontal accuracy is +/- 40 ft	Horizontal accuracy +/- 200 ft	Horizontal accuracy +/- 5 ft
How is distance represented?	SRMP, ARM to 1/100 th of mile	ARM to 1/100 th of mile	ARM to 1/100 th of mile	ARM to 1/1000 th of mile
Where does the information come from?	<ul style="list-style-type: none"> • Field collection using a vehicle transmission sensor • Highway Construction Contract Plans • SRview • Input from Staff 	Digitized from paper maps	Digitized from paper maps	Field collection using a vehicle with a GPS mounted receiver.
How often is it updated?	Ongoing	Quarterly	Annually	Ongoing
Who do I contact for information?	Lou Baker 570-2361	Ron Cihon 709-5510	Ron Cihon 709-5510	Allen Blake 570-2363

Tabular Data

1DOT-RNB160J

STATE OF WASHINGTON - DEPARTMENT OF TRANSPORTATION
T R I P S S Y S T E M
STATE HIGHWAY LOG

DATE 03/09/07
TIME 17:14:10
PAGE 74

SR 002 COUPLET
NEWPRT

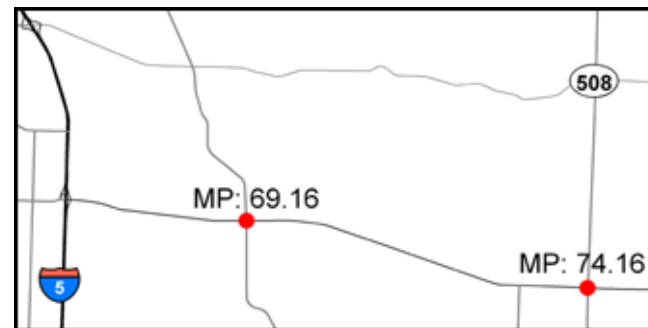
U.S. ROUTE - USSH

COUNTY PEND OREILLE

DOT DISTRICT 6

			-----WIDTH AND SURFACE INFORMATION-----																-----CLASSIFICATIONS-----											
			:DIRECTION TO INVENTORY		-BRIDGE		DECREAS/DIV			INCRS/UNDI			SPC	TOT	MTCE	CITY	ST	LEGAL												
			: :LEFT/RIGHT INDICATOR		-UXING-		NBR	LFT	RHT	LFT	RHT	RHT	USE	RDY	A	SE	NBR	PC	SPEED	T	P	S								
SRMP	B	ARM	FEATURE	D	LR	DESCRIPTION	OW	TC	L	D	I	W/S	W/S	W/S	WD/S	BR	W/S	W/S	W/S	WID	WID									
334.38	0.00		BEG ROUTE			NEWPRT				1	2						C 48A	C		48	1	02	0860	R1		25	R	P *		
			ENTER CITY			UNION AVE TO 4TH ST																								
			BEG CTLSEC			NEWPORT																								
			BEG ST	I		CONTROL SECTION 2601																								
			INTRSECTN	L		WALNUT ST																								
334.39	0.01		WYE CONN	L		SR 2			ST		Y																			
334.40	0.02		BEG SU LN	C		SR 2			ST		Y																			
334.43	0.05		BEG SU LN	C		TWO WAY TURN	10A			1	2						C 38A	C	10	48	1	02	0860	R1		25	R	P *		
334.43	0.05		END SU LN	C		TWO WAY TURN	10A			1	2						C 48A	C	\$\$\$	48	1	02	0860	R1		25	R	P *		
334.45	0.07		END ST	I		WALNUT ST				\$	2						C 42A	C	8	50	1	02	0860	R1		25	R	B *		
			BEG SU LN	R		BICYCLE	08A																							
			BEG ST	I		WASHINGTON AVE																								
			INTRSECTN	R		WASHINGTON AVE			CT		Y																			
			INTRSECTN	R		SR 20			ST		Y																			
334.53	0.15		INTRSECTN	B		SPRUCE ST			CT		Y																			
334.59	0.21		INTRSECTN	B		PINE ST			CT		Y																			
334.66	0.28		INTRSECTN	B		1ST ST			CT		Y																			
334.73	0.35		INTRSECTN	B		2ND ST			CT		Y																			
334.80	0.42		INTRSECTN	B		3RD ST			CT		Y																			
334.96	0.48		WYE CONN	L		SR 2			ST		Y																			
334.97	0.49		END ST	I		WASHINGTON AVE				2							C 42A	C	\$\$\$	42	1	02	0860	R1		25	R	B *		
			END SU LN	R		BICYCLE	08A																							
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			END CTLSEC			CONTROL SECTION 2601																								
			END SECTN			NEWPRT																								

GIS/Graphical Data



GPS LRS

The TDO has developed a more accurate LRS that will provide Global Positioning System (GPS) locations for all state highways including ramps. The TDO has collected geographic coordinates (x-longitude, y-latitude, z-elevation) in both directions of travel on all state routes. The resulting GPS coordinate data will be used to establish a GPS base map.

The geographic coordinate data needed to produce and maintain the GPS located state routes is collected using a customized GPS-equipped van. The data is collected while driving at highway speeds on the inside lane.

A GPS LRS is a series of geographic coordinates that, when linked together, create a representation of each state highway as it appears on the earth's surface. As other offices in WSDOT collect data via GPS technology it is vital that WSDOT has a GPS-based LRS that can support the level of accuracy derived from GPS devices (+/- 5 ft).

WSDOT's DMI Linear Referencing measures the distance traveled by a vehicle from point A to point B, similar to an odometer. This technology is generally accurate to +/- 52.8 ft.

Common Uses of GPS Located State Routes:

- Assist in identifying highway routing to direct emergency vehicles
- Provide a more accurate, universal method of locating and sharing data

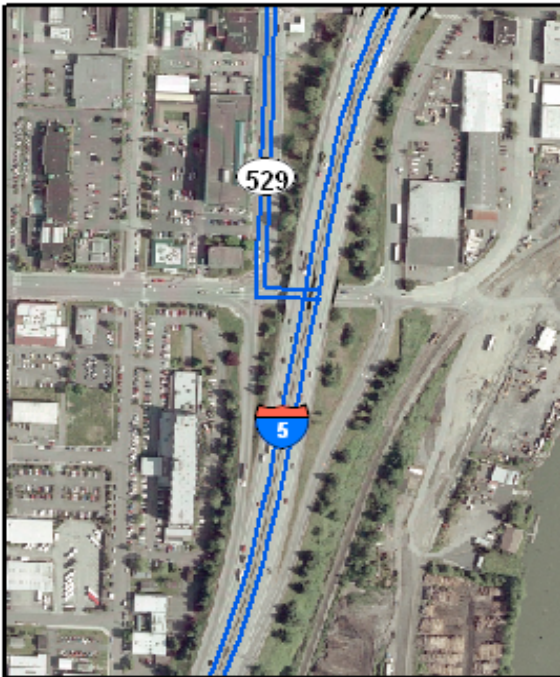
For more information visit:

<http://www.wsdot.wa.gov/mapsdata/tdo/gps.htm>

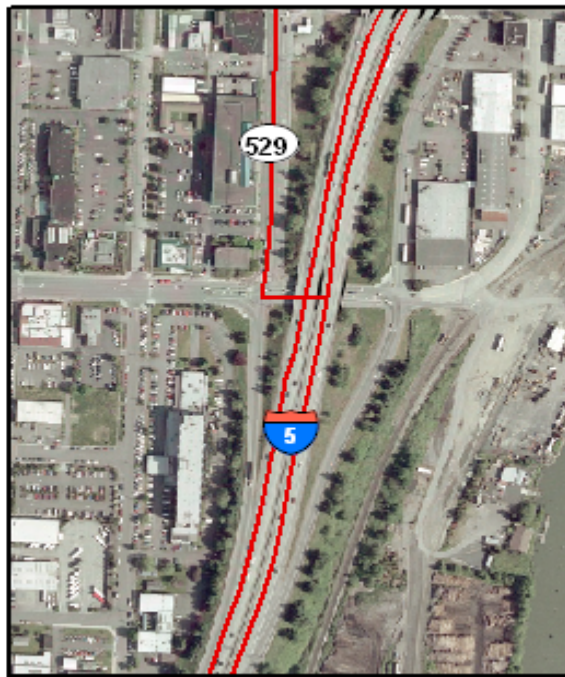
or contact (360) 570-2369

LRS Examples

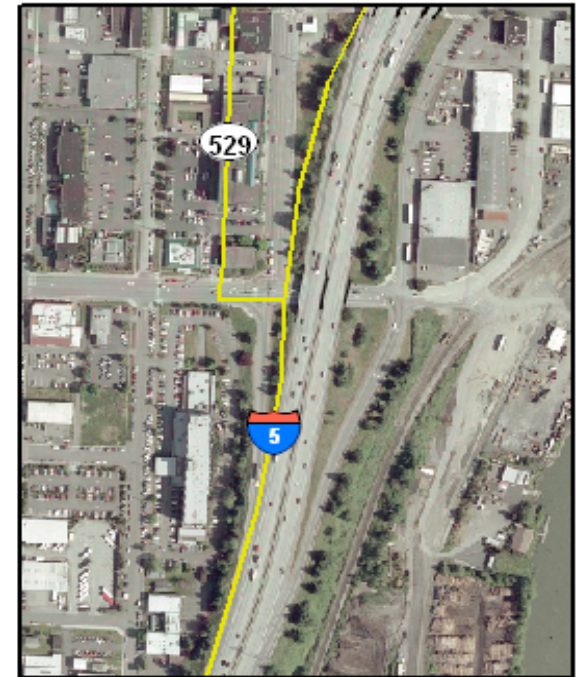
State Routes (GPS)



State Routes (24K)



State Routes (500K)



State Route 529 – Undivided Highway

Interstate 5 – Divided Highway

Divided Highway: Whenever any highway has been divided into two or more roadways by leaving an intervening space or by a physical barrier or clearly indicated dividing section or by a median island not less than eighteen inches wide formed either by solid yellow pavement markings or by a yellow crosshatching between two solid yellow lines so installed as to control vehicular traffic.

Undivided Highway: A highway that has none of the above characteristics.